UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
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4WMD

MEMORANDUM

SUBJECT: Update on Everglades phosphorus and science used to support May 1999 USEPA approval of 10 ppb numeric water quality phosphorus criterion for the Miccosukee Tribe of Indians of Florida.

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THRU: Richard Harvey, Director
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TO: John H. Hankinson, Jr.
Regional Administrator

Introduction

On May 25, 1999, the United States Environmental Protection Agency (USEPA) approved a 10 part per billion (ppb) phosphorus criterion for part of the Everglades marsh - the Miccosukee Tribe of Indians of Florida's federal reservation within Everglades Water Conservation Area 3A. At that time about 300 peer-reviewed scientific journal publications or technical reports were identified concerning Everglades phosphorus conditions, periphyton communities, macrophyte communities, wading bird foraging habitat, impacts of eutrophication, or the related cycling of oxygen, carbon, sulfur, nitrogen and phosphorus. Based on review of these Everglades reports, USEPA concluded that the 10 ppb criterion was "a scientifically defensible value which is not overly protective" and the criterion will protect the Class III-A designated use for the water body (propagation and maintenance of a healthy, well-balanced population of fish and other aquatic life and wildlife, and preservation of native plants and animals of the natural Everglades ecosystem). USEPA also noted that although in certain portions of the Everglades system long-term median or geometric mean phosphorus concentrations are less than 10 ppb, USEPA's review did not identify any published scientific information documenting changes in the natural flora or fauna in the Everglades system as a result of phosphorus concentration increasing from 5 ppb to 10 ppb. Lastly, USEPA noted that if

new data or scientific information are presented that demonstrate that 10 ppb is not protective, then the Tribe should revise the 10 ppb standard accordingly. (Scheidt, May 20, 1999 Memorandum, Page 6.).

Since May of 1999 the state of Florida has been proceeding with their efforts to establish a numeric phosphorus criterion for the remaining portions of the Everglades Protection Area, as required by the Florida's 1994 Everglades Forever Act. The Act addresses this issue in several provisions:

> "By December 31.2001, the department shall file a notice of rulemaking in the Florida Administrative Weekly to establish a phosphorus criterion in the Everglades Protection Area. In no case shall such phosphorus criterion allow waters in the Everglades Protection Area to be altered so as to cause an imbalance in the natural populations of aquatic flora or fauna. The phosphorus criterion shall be 10 parts per billion (ppb) in the Everglades Protection Area in the event the department does not adopt by rule such criterion by December 31, 2003." (Chapter 373.4592(4)(e)(2)., Florida Statute)

> "The department shall use the best available information to define relationships between waters discharged to, and the resulting water quality in, the Everglades Protection Area. The Department or the district shall use these relationships to establish discharge limits in permits for discharges into the EAA canals and the Everglades Protection Area necessary to prevent an imbalance in the natural populations of aquatic flora or fauna in the Everglades Protection Area, and to provide a net improvement in the areas already impacted." (Chapter 373.4592(4)(e)(3)., Florida Statute)

> "By December 31, 2006, the department and the district shall take such action as may be necessary so that water delivered to the Everglades Protection Area achieves state water quality standards, including the phosphorus criterion, in all parts of the Everglades Protection Area." (Chapter 373.4592(10), Florida Statute)

It is imperative to note that maintaining the Everglades' designated use and protection of Everglades flora and fauna from eutrophication simultaneously requires ***three equally essential components:***

- a protective numeric phosphorus criterion;
- a criterion compliance test that protects the entire water body. This includes how and where compliance with the criterion is determined.
- a water discharge permitting program with discharge limits that protect the water body.

The purpose of this document is to provide a brief update on relevant scientific information developed since May of 1999 concerning a numeric phosphorus criterion for the Everglades including a review of information presented in the FDEP and SFWMD 2001 Everglades Consolidated Report. USEPA previously provided comments on the September 2000 draft of the Consolidated Report.

Update

Since the May 1999 determination, over 110 additional scientific documents have been identified (attachment A). These are scientific efforts about the Everglades that are relevant to the issue of a numeric water quality standard for total phosphorus, impacts of phosphorus enrichment, or approaches for measuring compliance with numeric phosphorus criterion. This brings to over400 the number of such scientific reports. The Everglades continues to be the most intensively studied wetland in the world. Far more scientific information is available about phosphorus and the impacts of eutrophication in the Everglades than for any other wetland. A brief summary of noteworthy developments follows. (Please refer to Attachment A for complete references). Stated simply, the more recent information corroborates the previous USEPA determination, and there has been no scientific demonstration that a long-term phosphorus criterion exceeding 10 ppb would be protective of the Everglades' designated use and Everglades flora and fauna.

Deriving a numeric phosphorus criterion

Since 1999 South Florida Water Management District (SFWMD, or the District) and the Florida Department of Environmental Protection (FDEP, or the Department) have performed independent analyses of data collected in Water Conservation Area 2A (WCA2A) and the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Water Conservation Area 1). Based on these analyses, they report several findings.

SFWMD and FDEP analyzed data collected along a phosphorus enrichment gradient within WCA-2A from 1996 through 1998 (FDEP, 1999b; Frydenborg et al., 1999; McCormick et al., 2000; Payne et al., 2001). They found that at a distance of 6 to 8 kilometers downstream from the water structures discharging excess phosphorus (the S 10s), several changes were documented:

> "The abundant community of calcium-precipitating (i.e., calcareous) cyanobacteria and diatoms is replaced by a eutrophic assemblage of cyanobacteria and green algae in areas of the marsh within 7 km of the S10s where water column TP concentrations typically exceed background (TP>10 ug/L) levels and in controlled P dosing studies. Analyses of periphyton communities sampled along the P gradient between 1994 and 1998 showed a shift in dominance from taxa indicative of unpolluted, low P conditions toward those indicative of polluted, high P conditions at sampling stations between 7 and 8 km downstream of the S10s.

Statistical analyses showed a significant change in the species composition of the periphyton *community* occurred *between* stations where the water *column* P is elevated above background concentrations and reference stations, where water column P is maintained within the background range for this marsh. Controlled P dosing experiments have **shown** that many of these taxonomic changes are a direct result of P enrichment." (McCormick, et al., 2000, p. 3-2)

"Statistical analyses of monitoring data from the nutrient gradient indicated a significant shift from dominant sawgrass and slough vegetation to cattail between approximately 6 to 8 km downstream of the S-10s, where soil P concentrations generally exceeded 500 mg/kg." (McCormick, et al., 2000, p. 3-2)

"Studies conducted in WCA-2A using different methodologies showed no consistent effect of P enrichment on macroinvertebrate species richness or diversity. However, changes in taxonomic composition with increasing P enrichment, including a shift toward species able to tolerate the low oxygen conditions, have been documented in enriched areas." "Environmental indices calculated based on the taxonomic condition of these samples indicated that conditions in enriched areas were altered compared with the marsh interior. Statistical analyses indicated that the area affected by these changes included stations <7 km downstream of the S10s." (McCormick, et al., 2000, p. 3-3)

"Die1 oxygen changes measured downstream of the S10s between 1995 and 1998 showed that water column DO declined with P enrichment. Statistical analyses indicated that daily mean and minimum DO declined significantly at stations <7-8 km downstream compared with those in the marsh interior. A controlled field P dosing study conducted by the District provided supporting experimental evidence that these declines are a result of P enrichment **and not** some other environmental change." (McCormick, et al., 2000, p. 3-3)

"Results of data analyses completed to date for WCA-2A show that a number of ecological changes (microbial activity, periphyton, macrophyte, and invertebrate populations, marsh dissolved oxygen concentrations) occur along phosphorus gradients in this marsh and that many of these changes occur at stations where water column and soil TP exceed background levels of 10 ug/L and 500 mg/kg, respectively." (McCormick, et al., 2000, p. 3-3)

In a presentation of some of the same information from a phosphorus gradient in WCA2A (FDEP 1999b), FDEP used cluster analysis to determine differences across stations for various indicators such as bacteria, algae, benthic macroinvertebrates, plants and surface water dissolved oxygen. They found that the four or five marsh stations farthest from the water structure discharging excess phosphorus were consistently identified as different and minimally impacted sites or reference sites. They also noted that two other stations had characteristics between the

highly impacted sites and the reference sites and they considered those to be transitional. The. geometric mean surface water total phosphorus for the reference sites was 8.17 ppb, while it was 15.16 and 16.61 ppb for the transitional sites.

FDEP used a similar approach for a phosphorus gradient within the Arthur R. Marshall National Wildlife Refuge (WCA1, see Payne et al. 2000).

Based on the above analyses, FDEP and SFWMD came to the same conclusion that USEPA had made previously:

- WCA2A: "...since many of the individual changes observed can be interpreted as constituting an imbalance in the natural flora and fauna, the fact that many of the changes in the various trophic levels occur at the same location along the transect makes the definition of the imbalance point more robust and less controversial." (FDEP 1999b page 5-6). "Based on the median of the annual geometric mean of the P concentrations collected at the five reference sites over the period from 1978 through 1988, the Department recommends a phosphorus criterion of 8.5 ug/L to be measured as an annual geometric mean". (FDEP 1999b page 5-9). "As required by the Everglades Forever Act (EFA), the Department has utilized the best available information to develop a numeric phosphorus criterion of 8.5 ug/L (based on the annual geometric mean) with a confidence interval of 1.8 ug/L. This criterion is protective of the natural biological communities present within the minimally impacted areas of WCA-2 without being overly restrictive. Additionally, the criterion and confidence interval take into account the natural spatial and temporal variability as required by the EFA." (FDEP 1999b page 5-10)

WCA1: "Most of the change points indicate that the biological communities are altered significantly (i.e., imbalance occurs in the natural flora and fauna) between stations X3 and Z3 (2.2 km) and X2 (1.1 km). Since many of the individual changes observed can be interpreted as constituting an imbalance in the natural flora and fauna, the fact that many of the changes in the various trophic levels occur at the same location along the transect makes the definition of the imbalance point more robust and less controversial." "Since the point along the P-gradient where an imbalance occurs in the natural flora and fauna has been established, the phosphorus regime within the "balanced" or minimally impacted area can be used to develop a P-criterion that is protective of the remaining natural biological communities." ". ..the Department recommends that the P-criterion for WCA-1 be established based on the P regime determined at all five stations located within the reference area." The overall median annual geometric mean TP for these five sites is 9.09 ug/L. (Payne et al. 2000 pages 5-5 to 5-6).

-"Evaluation of data from the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Water Conservation Area 1) and Water Conservation Area 2A indicates

> that the Everglades Forever Act default total phosphorus criterion of 10 parts per billion (ppb) would be protective of the natural flora and fauna in both areas without being overly protective or below the natural background levels." (FDEP and SFWMD, 2001, Executive Summary page 2.)

Richardson et al. (2000) produced a final report to the Everglades Agricultural Area Environmental Protection District on their multi-year effort to derive a phosphorus threshold for the Everglades. They summarized results from controlled dosing experiments and phosphorus gradient research. Numerous metrics are reported such as for the algal, macrophyte, macroinvettebrate and community level. A classification and regression tree (CART) model was used to develop total phosphorus (TP) threshold breakpoints. This is the first such application of this model. Various TP breakpoints are reported depending upon the particular indicator: periphyton mat diatom density mean breakpoint of 15 ppb; *Utricularia purpurea* loss breakpoint of 15 ppb; *Eleocharis elongata* loss breakpoint of 15 ppb; relative diatom abundance for floating periphyton mats 15.8 ppb; relative diatom abundance on ***Eleocharis*** stems 17.1 ppb; blue-green algal biovolume 18.5 to 31.8 ppb; algal TP breakpoints of 23, 24, 26 and 33 ppb; relative diatom abundance for sediment periphyton 28.3 ppb; macroinvertebrate metric breakpoints of 8, 13, 15, 18 and 24 ppb. They concluded that dosing and gradient studies both provide evidence for a 20 ppb TP threshold zone and range. It should be noted that other independent investigators have documented in multiple publications that the periphyton community and macrophytes such as *Utricularia purpurea* and ***Eleocharis elongata*** provide numerous functions and are important defining characteristics of Everglades sloughs and wet prairies (see summaries in McCormick et al. 1999; McCormick et al. 2000; Payne et al. 2001; and Scheidt May 1999 memorandum). In addition, previous investigators have found that phosphorus concentrations above 10 ppb impact native periphyton communities and *Utricularia purpurea* (see Scheidt May 1999 memorandum and references cited such as McCormick and O'Dell 1996; Pan et al. 1997; McCormick and Stevenson 1998; and McCormick et al. 1999).

The 2001 Everglades Consolidated Report included external peer-review by an independent scientific panel. In their report, the peer-review panel notes that they are "concerned that the CART statistical analyses used by DUWC is inappropriate for setting criterion". They state that the DUWC information "would be more valuable if the interpretations were consistent 'with the mandate of the EFA." "Two central issues should be addressed to improve consistency with the EFA. First, the DUWC P levels are derived as mean breakpoints; i.e., there is roughly a 50 percent chance that there will be a significant shift in biological indicators. Clearly this is not a protective measure, and it would be more helpful to know what the lower confidence intervals are for the indicators considered. Second, the DUWC breakpoints are based on arithmetic means rather than the geomeans requested by the EFA. The DUWC data should be re-analyzed using geomeans. The DUWC studies do provide valuable information on the ecology of the Everglades but may not be appropriate for criterion setting". (Jordan et al. 2000, page 26)

With regard to the DUWC work, FDEP and SFWMD stated that "The DUWC evaluated the effect of introduced nutrients in an experimental flume study in Water Conservation Area 2A.

The DUWC researchers concluded that the phosphorus criterion should fall in the range of 17 to 22 ppb. However, based on the Department's review of the DUWC work, this range appears to be biased high and is not sufficiently protective of the Everglades flora or fauna. The peer review panel for this report noted that the DUWC research approach was no less scientifically valid than the District's, but concurred with the Department's findings regarding the DUWC conclusions. The peer review panel also noted that the DUWC researchers' interpretations of the data were not consistent with the mandates of the Everglades Forever Act." (FDEP and SFWMD, 2001, Executive Summary page 8). They also state that "The Department has conducted extensive evaluations of data collected by the District and DUWC. Evaluations of these data by the Department suggest that a criterion derived from these data may not be statistically differentiable from the 10 ppb default criterion or other criterion values from further research." (FDEP and SFWMD, 2001, Executive Summary page 8)

Based on our earlier 1999 review and a review of the more recent research and information contained in the 2001 Consolidated Report, a long-term numeric TP criterion in the 17 to 22 ppb range as proposed by DUWC cannot be demonstrated to be consistent with the requirements of the Everglades Forever Act or approvable under the requirements of the Clean Water Act concerning water quality standards.

Intentional Creation of a New Phosphorus Enriched Zone in the EPA

Roy and Gherini (2000) of Tetra Tech, in a report prepared for the Sugar Cane Growers Cooperative of Florida, theorized that historically phosphorus-rich water from Lake Okeechobee gave rise to a P-enriched zone south of the lake that extended into the present Everglades water conservation areas. They hypothesized that this naturally enriched zone was a productive area containing dense growths of pond apple and other upland species with an associated abundance of birds and wildlife. As summarized in the 2001 Everglades Consolidated Report, they used this information to suggest that Everglades restoration should include plans to recreate this habitat within the Everglades Protection Area. Payne et al. (2001) suggest that although attempts to create a localized P-enriched zone for recreating the localized pond apple forest "are not practical" (page 3-48), there may be some beneficial aspects to the concept if advanced phosphorus treatment technologies do not meet the numeric phosphorus criterion at the outflow. Payne et al. (2001) suggests that the Tetra Tech report provides evidence that areas within the Everglades Protection Area adjacent to the STA inflows that have P concentrations above 10 ppb "can be highly productive portions of a system that may provide a more diverse habitat for birds and animals. Thus, the use of the green advanced treatment technologies to achieve P concentrations slightly above the criterion and the allowance of a small zone on the marsh periphery where the P levels are slightly enriched, is likely to be more beneficial to the overall ecosystem than forcing the use of chemical treatment to achieve compliance with the criterion at all places. However, a thorough evaluation of the advanced treatment technology research currently being conducted will be needed before a final decision can be made." (Payne et al. 2001, page 3-48).

However, Chapter 2 of the 2001 Everglades Consolidated Report found that the technical basis of Roy and Gherini is flawed. "This proposal was found to be flawed because causal mechanisms for habitat heterogeneity, spatial gradients, wading bird abundance, biodiversity and peat accretion in the Everglades were incorrectly inferred from pre-drainage spatial patterns." (Sklar et al. 2001, page 2-23) Sklar et al. state further on pages 2-23 to 2-24 that:

- the central postulate of the proposal (that a transition zone associated with relatively high soil phosphorus is responsible for creating "natural" downstream gradients in vegetation, birds and peat) is less plausible than non-phosphorus based causal mechanisms;
- Although it is well known that pre-drainage soil thickness decreased from Lake Okeechobee southward through the Everglades, there is not any evidence in the Everglades that greater peat thickness is due to elevated phosphorus levels;
- Soil phosphorus gradients and fronts exist today and are a source of concern for restoration because they continue to expand, but they did not always exist. A 1929 publication noted that the content of phosphorus in custard apple soils adjacent to the lake and sawgrass soils farther to the south did not vary to any marked degree;
- "The idea that greater wildlife abundance and diversity was supported by elevated nutrients was also flawed." "The persistence of a low nutrient ridge and slough landscape results in an increase in wildlife downstream from lake Okeechobee rather than a decrease."

EPA has serious concerns with this approach. As we noted in our earlier comments on the draft 2001 Report, intentionally allowing unimpacted areas of the oiigotrophic Everglades to become nutrient-rich and degraded from current conditions is inconsistent with existing state water quality standards and the federal Clean Water Act anti-degradation requirements. Areas within the Everglades Protection Area are already impacted from nutrients and the state's EFA requires that these areas be restored and protected.

Phosphorus treatment technology

The scientific question of determining a total phosphorus concentration that will maintain the designated use and prevent an imbalance in natural populations of flora or fauna over the ***long-term*** is a scientific issue that is independent of ***present*** treatment technology. The numeric criterion is the number that if attained would prevent an imbalance for decades, while allowing for natural spatial and temporal variability. ***The numeric criterion will not change over time;*** unless new scientific information demonstrates that it is clearly under-protective or unnecessarily overprotective.

However, ***phosphorus treatment technology is continually changing.*** In the Everglades situation circa 1990, best management practices (BMPs) within the Everglades Agricultural Area were uncommon and there were no wetlands constructed and managed for phosphorus removal

(stormwater treatment areas). There was uncertainty and skepticism whether BMPs could attain a 25% phosphorus load reduction and whether an STA could consistently deliver less than 50 ppb total phosphorus or achieve a 75% load reduction. Ten years later FDEP and SFWMD (2001 Everglades Consolidated Report) report that:

- from 1995 to 2000 annual phosphorus load reduction in the EAA averaged 54%. and phosphorus concentrations averaged 108 ppb, down substantially from the 12-year pre-BMP average of 173 ppb. (Executive summary page 12)
- from 1994 through 1999 the Everglades Nutrient Removal Project had a cumulative TP outflow concentration of 21 ppb , and a TP load reduction of 83%. (Chimney et al., 2000)
- "Preliminary results from small-scale periphyton-based Stormwater Treatment Area research show monthly mean experimental outflow total phosphorus concentrations of 13-20 parts per billion." (Executive summary page 19)
- "During 1998-1999, average outflow total phosphorus concentrations from the submerged aquatic vegetation-dominated STA-1W Cell 4 was 14 ppb." (Executive summary page 20)
- "A short-duration, small scale test indicates that chemical treatment can achieve effluent of less than 10 ppb." (Executive summary page 20)

Criteria compliance issues.

The adequacy of any water quality standard for protecting the designated use of a water body is dependent upon a compliance measurement methodology that is also protective. The 1999 USEPA approval of the Miccosukee Tribe of Indians of Florida's 10 ppb criterion included approval of a methodology for measuring compliance that was determined to be protective of the designated use of the water body while allowing for natural seasonal and temporal variability. This approach focused on measuring the quality of the water entering the Reservation to insure it was in compliance with the water quality standard, thus protecting all of the downstream Reservation. More specifically, the Tribe's approach includes measuring phosphorus at locations where canals discharge into the Reservation and in the marsh immediately downstream of the Reservation boundary. During April of 1999 FDEP distributed a draft methodology for determining compliance with the numeric phosphorus criterion for WCA-2A (FDEP, 1999a). FDEP divided the marsh into "impacted" and "unimpacted" zones based upon 600 mg/kg O-10 cm soil total phosphorus contours. The proposed network consisted of 10 stations in the impacted zone and 14 stations in the unimpacted zone. The impacted zone would be tested for "net improvement" and the unimpacted zone would be tested for compliance with the numeric criterion. This distinction was inferred from the Everglades Forever Act (EFA), which states that "Compliance with the phosphorus criterion shall be based on a long-term geometric mean of concentration levels to be measured at sampling stations recognized from research to be reasonably representative of receiving waters in the Everglades Protection Area, and so located so as to assure that the Everglades Protection Area is not altered so as to cause an imbalance in natural populations of aquatic flora and fauna and to assure a net improvement in the areas

already impacted." (Chapter 373.4592(4)(e)3., Florida Statute) FDEP 1999b presented the same methodology, with the slight modification that two of 14 stations in the "unimpacted" area appear to be moved closer to the eventual STA2 outflow. However, as previously noted the EFA also requires that:

> - in no case shall a phosphorus criterion allow waters in the Everglades Protection Area to be altered so as to cause an imbalance in the natural populations of aquatic flora or fauna;
> -by December 31, 2006 water delivered to the Everglades Protection Area is to achieve state water quality standards, including the phosphorus criterion, in all parts of the Everglades Protection Area;
> -permit discharge limits for discharges into the EAA canals and the Everglades Protection Area are to be established as are necessary to prevent an imbalance in the natural populations of aquatic flora or fauna in the Everglades Protection Area.

In addition, the federal Clean Water Act requires that water quality criteria must be protective of the designated use for the entire water body.

Walker (1999f) evaluated this compliance methodology to determine its effectiveness in protecting the WCA-2A water body. Walker noted the following:

> -Numeric threshold value, summary statistic (geometric mean or others), marsh water depth, temporal scale of the test, and spatial scale (number and location of sampling stations) are all important to the numerical interpretation of the narrative nutrient standard.
>
> - The spatial scale (marsh sampling station locations) is one of the more sensitive design parameters. If the objective is to protect the entire marsh, then the proposed concept of using a geometric mean of a station grid distributed over a large area is not appropriate. The STA discharge zones within the EPA immediately to the south of STA2 and STA 3/4 are such that phosphorus gradients are expected. Measuring compliance based upon an area-wide geometric mean will allow elevated concentrations and resulting biological impacts in areas immediately downstream of phosphorus inputs. The proposed test is designed to protect the "average" marsh, not the "entire" marsh.
>
> - Because of the proposed station locations and presence of concentration gradients within the unimpacted portion of WCA2A, the geometric mean station grid will underestimate the true geometric mean over the entire unimpacted area.
>
> - Walker predicted P concentrations at the WCA2A compliance monitoring stations for alternative STA-2 discharge concentrations. For an STA2 discharge of 50 ppb, 15% to 23% of WCA2 (about 16,000 to 24,000 acres) would exceed 10 ppb, depending upon

whether marsh background concentration is assumed to be 4 or 8 ppb. Most of this acreage of new phosphorus impact is presently unimpacted. Yet, the geometric mean averaged across the proposed stations would meet the numeric criterion.

- As a consequence of the coarse station grid and expected concentration gradients, the maximum concentration within the previously unimpacted area is underestimated. With an STA2 discharge of 50 ppb and background concentration of 8 ppb, 22 ppb would be the highest concentration at a sampling station (about 3 km from the STA2 discharge), yet concentrations in the unimpacted area just south of STA2 would be about 50 ppb.

- For an STA2 discharge concentration of 25 ppb and background concentration of 8 ppb, the maximum station concentration would be 13.6 ppb, the geometric mean grid concentration would be 9.2 ppb and the water body would pass the compliance test. However, 10 ppb would be exceeded in 16% of the water body (about 17,100 acres).

- If the proposed station locations were used to calculate the upstream STA2 outflow concentration/discharge limit, the *compliance* test *would allow an STA2 discharge concentration of 39ppb to 157 ppb*, depending upon whether marsh background concentration is assumed to be 8 or 4 ppb.

Walker concluded that a transect design in the marsh area immediately downstream of the STA discharge would be more effective in determining to what extent the marsh as a whole is being protected from adverse impacts of nutrient inputs. This approach would also be much more cost-effective. He also recommended that compliance with the criterion be measured at individual marsh stations to protect all locations, not averaged across stations to protect an average condition.

Summary

1- The Clean Water Act requires that the numeric criterion must be protective of the designated use for the entire water body.

2- The Everglades Forever Act requires that the numeric phosphorus criterion must be met in all parts of the Everglades Protection Area.

3- Since 1999 over 110 additional scientific reports about the Everglades have been published that are relevant to a numeric phosphorus criterion. This brings to over 400 the number of such scientific reports.

4- The Everglades continues to be the most intensively studied wetland in the world. Far more scientific information is available about phosphorus and the impacts of eutrophication in the Everglades than for any other wetland.

5- In May of 1999, based on review of Everglades science, USEPA approved a 10 ppb numeric criterion for phosphorus for the Miccosukee Tribe of Indians of Florida federal reservation in Everglades Water Conservation Area 3A. USEPA determined that the 10 ppb criterion is scientifically defensible and is not overly protective. It is possible to meet this criterion over the long-term while allowing for natural spatial and temporal variability.

6- Since May of 1999, FDEP and SFWMD independently analyzed data for Everglades Water Conservation Area 2 and Arthur R. Marshall Loxahatchee National Wildlife Refuge (Water Conservation Area 1). They concluded that the 10 ppb Everglades Forever Act default criterion would be protective of the natural flora and fauna in both areas without being overly protective or below the natural background levels.

7- The 10 ppb criterion is slightly above background for long-term water quality monitoring stations throughout the Everglades, some of which have a long-term median or geometric mean of 5 to 6 ppb. However, there has yet to be any scientific demonstration that adverse impacts to flora or fauna occur as phosphorus concentration increases from background up to 10 ppb.

8- There are several sources of scientific information indicating that as phosphorus concentration exceeds 10 ppb changes to flora and fauna occur.

9-There has been no scientific demonstration that a long-term phosphorus criterion exceeding 10 ppb would be protective of Everglades flora and fauna and the Everglades' designated use. This is especially noteworthy given the vast body of science on Everglades phosphorus and phosphorus enrichment impacts.

10- The derivation of a numeric phosphorus criterion for a water body that is protective over the long-term is a scientific issue that is independent of the present availability of treatment technologies. Accordingly, the scientific derivation of a numeric criterion should not be influenced by concerns regarding currently available treatment options.

11- Protection of Everglades flora and fauna from eutrophication simultaneously requires three equally essential components:

- a protective numeric phosphorus criterion;
- a criterion compliance test that protects the entire water body. This includes how and where compliance with the criterion is determined.
- a water discharge permitting program with discharge limits that protect the water body.